

The Development of Nearshore Stressor Conceptual Models for Chinook Recovery Planning in South Puget Sound

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Introduction

In July 2004 the South Puget Sound Salmon Recovery Group (SPSSRG) submitted to Shared Strategy for Puget Sound *The Chinook & Bull Trout Recovery Approach for the South Puget Sound Nearshore*. This draft Chinook and Bull Trout recovery plan is the nearshore complement to the Nisqually River recovery plan. Shared Strategy will integrate this plan into the overall Puget Sound ESU Chinook Recovery Plan due June 2005.

The South Puget Sound includes the marine waters and related nearshore habitats located south of the Tacoma Narrows Bridge. It is the southern end of the larger Puget Sound fjord estuary complex, an area separated from central Puget Sound by a narrow, shallow sill associated with the Tacoma Narrows. The Nisqually River is the only major river system in the basin. Numerous streams drain into South Puget Sound that, when combined, rival the biological output of large Puget Sound systems. The total surface area of marine waters in South Puget Sound is approximately 394 square kilometers. More than 50% of South Puget Sound is less than 36.6 meters deep and only a very small percentage is deeper than 100 meters. We recognized nine distinct South Puget Sound landscapes, representing seven inlets and two island groups:

- Budd Inlet
- Carr Inlet
- Case Inlet
- Eld Inlet
- Hammersley Inlet & Oakland Bay
- Hartstene Island Group
- Henderson Inlet
- McNeil Island Group
- Totten & Skookum Inlets

Stressor Conceptual Models

If South Puget Sound is to have an ecosystem that supports Chinook and bull trout, there must be properly functioning nearshore habitats that serve their rearing, refuge, feeding, physiological transition, and migratory needs. The deterministic factors that influence properly functioning nearshore habitats are natural processes. In South Puget Sound, human activities have dramatically disrupted the function of many natural processes. These disruptions change habitat, and ultimately, the ecosystem that Chinook and bull trout have adapted to through evolutionary development. On a temporal scale, many of these human-induced stressors have been sudden, creating significant impacts that have led to declines in the viability of both species.

To understand how these stressors affect Chinook and bull trout, the SPSSRG developed a series of conceptual models. These models are a graphic representation of the hypotheses regarding how stressors alter both the biotic and abiotic components of the habitat. Each model also explores the resulting effect on Chinook and bull trout populations, which it then relates to viable salmon population (VSP) parameters that

influence planning targets specific for Chinook. The SPSSRG identified twelve major human-induced stressors on natural processes specific to South Puget Sound. These are:

- Shoreline armoring
- Overwater structures
- Ramps
- Stormwater/Wastewater
- Landfill below the higher high water line
- Riparian loss
- Wetland and estuarine modification
- Input of toxic components
- Predation
- Boat traffic
- Invasive species
- Shellfish aquaculture

VSP Parameter Conceptual Models

Viable Salmonid Population (VSP) parameters include Life History Diversity, Spatial Structure, Capacity, and Productivity. One weakness of our current Stressor Conceptual Models is that the links between the Salmon Population Effects and changes in the VSP parameters (Hypothesis 4 of the Stressor Conceptual Models) are not well understood. To make the Stressor Conceptual Models more explicit, we are currently developing conceptual models for Chinook VSP parameters in specific geographic areas. Making the VSP Parameters more explicit will allow us to better explain to decision makers and the public why different recovery strategies are directed at different geographic areas and stressors, and that they will benefit different life history stages and life history types.

Life History Diversity. Chinook salmon display several different life history strategies. The life histories differ in the time and duration that juveniles spend in different elements of the landscape.

Spatial Structure. The South Puget Sound is used extensively by salmon from throughout the Puget Sound region. However, the major Chinook producing system in the South Sound is the Nisqually River. Those landscapes (such as pocket estuaries) nearest to the Nisqually Delta that provide rearing and refuge functions will likely provide the greatest benefit to Nisqually Chinook, particularly for the younger life stages.

Capacity. Capacity estimates require an area estimate of each landscape type derived from a GIS analysis of the National Wetlands Inventory and NOAA bathymetry data. The area estimates are multiplied by estimates of juvenile Chinook density by landscape types derived from the literature.

Productivity. The Productivity component is currently the least well developed of the VSP Parameter Conceptual Models. Productivity estimates require understanding the proportion of each life stage that occupies a habitat type, and the survival of one life stage to the next.

A draft of *The Chinook & Bull Trout Recovery Approach for the South Puget Sound Nearshore* is available online at <http://www.piercecountywa.org/pc/abtus/ourorg/exec/specialprojects/chinookrecovery.htm>, or by contacting the primary author.